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EXAMINER	
YOUNG, NATASHA E	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/797,455	ALVIN ET AL.	
	Examiner	Art Unit	
	Natasha Young	1743	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 02 August 2007.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-6,8-12,14-16,18-22 and 24-33 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-6,8-12,14-16,18-22 and 24-33 is/are rejected.

7)☒ Claim(s) 14-16, 18 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claims 14-16 and 18 are objected to because of the following informalities: Claims 14-18 depend on cancelled claim 13. The claims should depend on claim 12. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 6, 9, and 20-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1) in view of Dalla Betta et al (US 5,183, 401) and Bruck (US 6,365,283 B1).

Regarding claim 6, Horiike et al teaches a catalytic combustor comprising: a first catalytic stage receiving an oxidizer and fuel and discharging a partially oxidized fuel/oxidizer mixture; and a second catalytic stage receiving the partially oxidized fuel/oxidizer mixture and further oxidizing the partially oxidized fuel/oxidizer mixture, the second catalytic stage comprising a passageway for conducting a bypass portion of the partially oxidized fuel/oxidized mixture past a catalyst disposed therein; the transition stage comprises a flow area region disposed between an inlet end receiving the partially oxidized fuel/oxidizer mixture from the first catalytic stage and an outlet end discharging the partially oxidized fuel/oxidizer mixture onto the second catalytic stage (see Abstract; column 1, lines 19-41 and line 53 through column 2, line 8; column 4, lines 50-53; and figure 4 and 6).

Horiike does not teach a narrowed flow area transition region; the second catalytic stage having an outlet temperature elevated sufficiently to completely oxidize the mixture without using a separate ignition source; and an oxidation completion stage disposed downstream of the second catalytic stage for recombining the first and second portions of the mixture and completing oxidation of the mixture.

Dalla Betta et al teaches temperatures above the autoignition temperature, and homogeneous completion zone defined as an area to achieve substantial completion of combustion (see column 12, lines 54-64) and column 13, lines 21-26).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Dalla Betta et al without destroying the teachings of Horiike et al to produce working gas which contains substantially no NO_x and is at a temperature comparable to normal combustion process without shortening the useful life of the catalyst and its support (see column 14, lines 5-12).

Bruck teaches wherein the second catalytic stage further comprises a plurality of separate catalytic elements comprising an identical cross-section and being angularly rotated about the flow axis with respect to an adjacent catalytic element effective to cause mixing of a flow about the flow axis; and a transition stage disposed between the first catalytic stage and the second catalytic stage and that as fluid flows through the catalyst support the channels increase causing a narrowing of flow (see figures 1 and 5).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Bruck to permit continuous catalytic conversion even under heavily fluctuating operating condition with phases in which relatively cold exhaust emissions reach the catalytic converter (see column 3, lines 61-65).

Claims 9 and 20-21 depend on claim 6 such that the reasoning used to reject claim 6 will be used to reject the dependent portions of the claims.

Regarding claim 9, Horiike et al does not teach the second catalytic stage further comprises a first region comprising a first catalytic material, and a second region disposed downstream of the first region and comprising a second catalytic material different from the first catalytic material.

Dalla Betta et al teaches the second catalytic stage further comprises a first region comprising a first catalytic material, and a second region disposed downstream of the first region and comprising a second catalytic material different from the first catalytic material (see column 10, 2nd and 4th paragraphs),

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Dalla Betta et al without destroying the teachings of Horiike et al to produce working gas which contains substantially no NO_x and is at a temperature comparable to normal combustion process without shortening the useful life of the catalyst and its support (see column 14, lines 5-12).

Regarding claim 20, Horiike et al teaches the second catalytic stage comprises a plurality of plates defining longitudinal passageways (see figures 2 and 3 and column 1, lines 8-13).

Regarding claim 21, Horiike et al teaches the second catalytic stage further comprises a catalyst support selected from the group consisting of a honeycomb structure, a tower packing structure, and a packed particle structure (see figure 2).

Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1) in view of Dalla Betta et al (US 5,183, 401), Bruck (US 6,365,283 B1), and Fay, III et al (US 6,040,266).

Regarding claim 1, Horiike et al teaches a catalytic combustor comprising: a first catalytic stage comprising a metallic catalyst support and receiving an oxidizer and a fuel and discharging a partially oxidized fuel/oxidizer mixture; a second catalytic stage disposed within a pressure boundary defining a pressure boundary cross-sectional flow area, the catalyst support receiving a first portion of the mixture and presenting a support cross sectional flow area less than the pressure boundary cross-sectional flow area to define a bypass passageway for allowing a second portion of the mixture to bypass the catalytic support; and a transition stage disposed between the first catalytic stage and the second catalytic stage disposed between an inlet end receiving the partially oxidized fuel/oxidizer mixture from the first catalytic stage and an outlet end discharging the partially oxidized fuel/oxidizer mixture into the second catalytic stage (see Abstract; column 1, lines 19-41 and line 53 through column 2, line 8; column 4, lines 50-53; and figure 4 and 6).

Horiike does not teach a narrowed flow area transition region; the second catalytic stage comprising a ceramic reticulated foam catalyst support; the second catalytic stage having an outlet temperature elevated sufficiently to completely oxidize the mixture without using a separate ignition source; and an oxidation completion stage disposed downstream of the second catalytic stage for recombining the first and second portions of the mixture and completing oxidation of the mixture.

Dalla Betta et al teaches ceramic catalytic supports, temperatures above the autoignition temperature, and homogeneous completion zone defined as an area to achieve substantial completion of combustion (see column 8, lines 25-29; column 12, lines 54-64); and column 13, lines 21-26).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Dalla Betta et al without destroying the teachings of Horiike et al to produce working gas which contains substantially no NO_x and is at a temperature comparable to normal combustion process without shortening the useful life of the catalyst and its support (see column 14, lines 5-12).

Fay, III et al teach that ceramic or metallic reticulated foam for catalyst systems provide much greater surface contact and mixing at equivalent or reduced pressure drops and reduced catalyst dimensions compared to honeycomb structure (column 3, line 41 – column 4, line 35).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the combined teachings of Horiike et al and Dalla Betta et al with the teachings of Fay, III et al because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Fay, III et al column 3, lines 57-62).

Bruck teaches that as fluid flows through the catalyst support the channels increase causing a narrowing of flow (see figures 1 and 5).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Bruck to permit continuous catalytic conversion even under heavily fluctuating operating condition with phases in which relatively cold exhaust emissions reach the catalytic converter (see column 3, lines 61-65).

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1), Dalla Betta et al (US 5,183, 401), Bruck (US 6,365,283 B1), and Fay, III et al (US 6,040,266) as applied to claim 1, and further in view of Spadaccini et al (US 5,207,053).

Claim 2 depends on claim 1 such that the reasoning used to reject claim 1 will be used to reject the dependent portions of the claim.

Regarding claim 2, Horiike et al does not teach the second catalytic stage further comprises a catalytic material selected from the group consisting of perovskite, zeolite, and hexaaluminate.

Spadaccini et al teach that catalyst used for combustion of fuel for turbines include precious metal catalyst such as platinum and palladium and zeolites (col. 5, lines 3-7).

It would have been obvious to one having ordinary skill in the art at the time the invention to have used any of palladium, platinum or zeolite for the catalytic material in the ceramic foam in the combustor of the references as combined, as taught by Spadaccini et al as alternative catalyst used for combustion of fuel for turbines. The use of zeolite, as claimed in Claim 2, would have been obvious to one of ordinary skill in the

art as a suitable catalyst for the second catalytic stage in the combustor of the references as combined.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1), Dalla Betta et al (US 5,183, 401), Bruck (US 6,365,283 B1), and Fay, III et al (US 6,040,266) as applied to claim 1, and further in view of Kato (US 5,439,651).

Claim 4 depends on claim 1 such that the reasoning used to reject claim 1 will be used to reject the dependent portions of the claim.

Regarding claim 4, Horiike et al does not teach the ceramic reticulated foam catalytic support comprises a cruciform cross-section.

The Kato reference teaches a cruciform cross-section (see column 3, 5th paragraph and Figure 3).

It would have been obvious to one having ordinary skill in the art at the time the invention to have modified the combustor of the references as combined to provide a catalyst foam support with a cruciform cross-section, as suggested by Kato, to provide a foam support providing bypass passages of different cross-sectional area depending on the desired amount of bypass.

Claims 3 and 5 rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1), Dalla Betta et al (US 5,183, 401), Bruck (US 6,365,283 B1), and Fay, III et al (US 6,040,266) as applied to claim 1 above, and further in view of Lywood et al (US 5,228,847).

Claims 3 and 5 depend on claim 1 such that the reasoning used to reject claim 1 will be used to reject the dependent portions of the claims.

Regarding claim 3, Horiike et al does not teach the bypass passageway is disposed around a portion of a perimeter of the ceramic reticulated foam catalytic support.

Fay, III et al teach that ceramic or metallic reticulated foam for catalyst systems provide much greater surface contact and mixing at equivalent or reduced pressure drops and reduced catalyst dimensions compared to honeycomb structure (column 3, line 41 – column 4, line 35).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Fay, III et al because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Fay, III et al column 3, lines 57-62).

Lywood et al disclose using a catalyst body, which provides outer annular bypass region (see column 7, lines 25-32, Fig. 1), thus a bypass passageway disposed around a perimeter of the foam support as claimed.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Lywood et al to eliminate the need for high activity catalysts (see column 3, lines 1-3).

Regarding claim 5, Horiike et al does not teach the ceramic reticulated foam support comprises a donut-shaped cross-section.

Lywood et al disclose using a catalyst body having a central hole (column 7, lines 19-20, Fig. 1), thus a foam support comprising a donut-shaped cross-section as claimed.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Lywood because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Lywood et al column 3, lines 57-62).

Claims 8 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1), Dalla Betta et al (US 5,183, 401) and Bruck (US 6,365,283 B1) as applied to claim 6, and further in view of Spadaccini et al (US 5,207,053).

Claims 8 and 22 depend on claim 6 such that the reasoning used to reject claim 6 will be used to reject the dependent portions of the claims.

Regarding claim 8, Horiike et al does not teach the second catalytic stage further comprises a catalytic material selected from the group consisting of perovskite, zeolite, and hexaaluminate.

Spadaccini et al teach that catalyst used for combustion of fuel for turbines include precious metal catalyst such as platinum and palladium and zeolites (col. 5, lines 3-7).

It would have been obvious to one having ordinary skill in the art at the time the invention to have used any of palladium, platinum or zeolite for the catalytic material in

the ceramic foam in the combustor of the references as combined, as taught by Spadaccini et al as alternative catalyst used for combustion of fuel for turbines. The use of zeolite, as claimed in Claim 2, would have been obvious to one of ordinary skill in the art as a suitable catalyst for the second catalytic stage in the combustor of the references as combined.

Regarding claim 22, Horiike et al does not teach the first catalytic stage comprises a rich catalytic stage.

Spadaccini et al teach that staged rich/lean combustion reduces No_x emissions (see column 2, lines 3-6).

It would have been obvious to one having ordinary skill in the art at the time the invention to have provided the first and second catalytic stages in the method of Horiike et al as a rich catalytic stage as claimed in Claim 22, as taught by Spadaccini et al to reduce No_x emissions.

Claims 10,12, 14-16 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1), Dalla Betta et al (US 5,183, 401) and Bruck (US 6,365,283 B1) as applied to claim 6, and further in view of Fay, III et al (US 6,040,266).

Claims 10 and 12 depend on claim 6 such that the reasoning used to reject claim 6 will be used to reject the dependent portions of the claims.

Regarding claim 10, Horiike et al teaches two catalytic stages with metal supports (see Abstract).

Horiike et al does not teach a first catalytic material disposes on a metallic support in the first catalytic stage; and a second catalytic material, different from the first catalytic material, disposed on a ceramic support in the second catalytic stage.

Dalla Bella et al teaches the first catalytic material is disposed on a metallic support on the first catalytic stage and a second catalytic material different from the first catalytic material disposed on a catalytic support in the second catalytic stage (see column 6, lines 43-46 and column 10, lines 13-31) but does not disclose disposing the catalytic material in the second catalytic stage on a ceramic support of ceramic reticulated foam.

The Fay, III et al reference teaches ceramic reticulated foam catalyst support provides greater surface contact and mixing at equivalent or reduced pressure drops and greatly reduced catalyst dimensions than honeycomb structure (column 3, line 43-47, column 4, lines 4-6).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the combined teachings of Horiike et al and Dalla Betta et al with the teachings of Fay, III et al because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Fay, III et al column 3, lines 57-62).

Regarding claim 12, Horiike et al does not teach the second catalytic stage further comprises a catalytic material disposed on ceramic reticulated foam.

The Fay, III et al reference teaches ceramic reticulated foam catalyst support provides greater surface contact and mixing at equivalent or reduced pressure drops and greatly reduced catalyst dimensions than honeycomb structure (column 3, line 43-47, column 4, lines 4-6).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Fay, II et al because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Fay, III et al column 3, lines 57-62).

Claims 14-16 and 18 depend on claim 12 such that the reasoning used to reject claim 12 will be used to reject the dependent portions of the claims.

Regarding claim 14, Horiike et al does not teach the separate catalytic elements comprise ceramic reticulated foam catalyst supports comprising different size grades.

Fay, III teaches that a ceramic reticulated foam support can be used instead of a metallic support in an exhaust system (see column 3, lines 18-25). The ceramic structure is porous with pore densities from 10-1000 ppi (see column 4, line 46 and lines 51-54), which implies different pore size grades.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teaching of Fay, III et al because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Fay, III et al column 3, lines 57-62).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to produce ceramic reticulated foam catalyst supports with different pore size grade to obtain the desired degree of catalytic combustion.

Regarding claim 15, Horiike et al teaches separate catalytic elements comprise different cross-section (see figure 14).

Regarding claim 16, Horiike et al teaches separate catalytic elements (see figure 14).

Horiike et al does not teach different catalytic material on those elements.

Dalla Betta et al teaches the separate catalytic elements comprise different catalytic material (see column 10, 2nd paragraph and column 11, 2nd and 4th paragraphs).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Dalla Betta et al without destroying the teachings of Horiike et al to produce working gas which contains substantially no NO_x and is at a temperature comparable to normal combustion process without shortening the useful life of the catalyst and its support (see column 14, lines 5-12).

Regarding claim 18, Horiike et al teaches each catalytic element is spaced apart from an adjacent catalytic element along the flow axis (see figure 6) since the intermediate stage, which has no catalytic activity is in between the catalytic elements along the flow axis.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1), Dalla Betta et al (US 5,183, 401) and Bruck (US 6,365,283 B1) as applied to claim 6, and further in view of Yoshizaki (US 5,800,789).

Claim 11 depend on claim 6 such that the reasoning used to reject claim 6 will be used to reject the dependent portions of the claims.

Regarding claim 11, Horiike et al does not teach the second catalytic stage further comprises a metallic support comprising a metal alloy selected from the group consisting of molybdenum disilicide, iron-chromium-aluminum, and iron alumnide.

The Yoshizaki reference teaches a metallic support for platinum or palladium catalyst comprising iron-chromium-aluminum alloy (column 6, 9th paragraph).

It would have been obvious to one having ordinary skill in the art at the time the invention to have provided the metal support for the catalyst of the second combustion stage of the Horiike et al reference of iron-chromium-aluminum alloy, as taught by Yoshizaki, as metal support used for platinum or palladium catalyst.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1), Dalla Betta et al (US 5,183, 401) and Bruck (US 6,365,283 B1) as applied to claim 6, and further in view of Huttenhofer et al (US 5,820,832).

Claim 19 depends on claim 6 such that the reasoning used to reject claim 6 will be used to reject the dependent portions of the claim.

Regarding claim 19, the Horiike et al reference teaches a second catalytic stage (see Abstract) further comprises a tubular catalyst support (see figures 1 and 2).

The Horiike et al reference does not teach the tubular catalyst support coated with a catalytic material on an outside surface and an inside surface.

The Huttenhofer et al reference teaches a catalyst support coated with a catalytic material on an outside surface and an inside surface (see column 4, 13th paragraph). The Huttenhofer reference does not teach a tubular catalyst support.

It would have been obvious to one having ordinary skill in the art at the time the invention to modify the second combustion stage of the Horiike et al reference with catalytic material coating the outside and inside surfaces. It would give the catalytic structure added utility within the process where the fuel may come in contact with the catalyst on the outside surface, inside surface, or both.

Claims 24-27 and 29-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1) in view of Lywood et al (US 5,228,847), Bruck (US 6,365,283 B1), Fay, III et al (US 6,040,266).

Regarding claim 24, Horiike et al teaches a catalytic combustor comprising: an upstream pressure boundary comprising a catalytic surface disposed for receiving a fuel/oxidizer mixture and discharging a partially oxidized fuel/oxidizer mixture; a downstream pressure boundary defining a pressure boundary cross-sectional flow area for receiving the partially oxidized fuel/oxidizer mixture; a catalyst-coated support disposed within the second pressure boundary for receiving a first portion of the mixture; and a transition pressure boundary disposed between the upstream pressure boundary and the downstream pressure boundary disposed between an inlet end receiving the partially oxidized fuel/oxidizer mixture from the upstream pressure

boundary and an outlet end discharging the partially oxidized fuel/oxidizer mixture into the downstream pressure boundary (see Abstract; column 1, lines 8-13 and lines 19-41 and line 53 through column 2, line 8; column 4, lines 50-53; and figure 4 and 6).

Horiike does not teach a narrowed flow area transition region; the downstream pressure boundary comprising a ceramic reticulated foam catalyst support for receiving a first portion of the mixture and presenting a support cross-sectional flow area less than the downstream pressure boundary cross-sectional flow area to define a bypass passageway for allowing a second portion of fuel/oxidizer mixture to bypass the foam support.

Bruck teaches that as fluid flows through the catalyst support the channels increase causing a narrowing of flow (see figures 1 and 5).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Bruck to permit continuous catalytic conversion even under heavily fluctuating operating condition with phases in which relatively cold exhaust emissions reach the catalytic converter (see column 3, lines 61-65).

Butler et al defines the Venturi effect as the increase in velocity of a stream of gas or liquid as it passes from one area through another area of smaller size or diameter.

Fay, III et al teach that ceramic or metallic reticulated foam for catalyst systems provide much greater surface contact and mixing at equivalent or reduced pressure

drops and reduced catalyst dimensions compared to honeycomb structure (column 3, line 41 – column 4, line 35).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Fay, III et al because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Fay, III et al column 3, lines 57-62).

Lywood et al disclose a catalytic combustor comprising: a pressure boundary defining a pressure boundary cross-sectional flow area for conveying a fuel/oxidizer mixture; and a catalyst bodies (catalyst-coated, foam-support), either of foam or honeycomb, disposed within the pressure boundary for receiving a first portion of the mixture and presenting a support cross-sectional flow area less than the pressure boundary cross-sectional flow area to define a bypass passageway for allowing a second portion of the fuel/oxidizer mixture to bypass the foam support (see column 4, line 64-65; column 7, lines 25-32; and Fig. 1).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Lywood et al to eliminate the need for high activity catalysts (see column 3, lines 1-3).

Claims 25-27 and 29-31 depend on claim 24 such that the reasoning used to reject claim 24 will be used to reject the dependent portions of the claims.

Regarding claim 25, Horiike et al does not teach the reticulated foam support comprises a cross-section sized to bypass from 25% to 60% of the mixture past the foam support element.

Fay, III et al teach that ceramic or metallic reticulated foam for catalyst systems provide much greater surface contact and mixing at equivalent or reduced pressure drops and reduced catalyst dimensions compared to honeycomb structure (column 3, line 41 – column 4, line 35).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Fay, III et al because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Fay, III et al column 3, lines 57-62).

Lywood et al teaches a catalyst body which provides outer annular bypass region, which forms about 32% of the total cross section area (column 7, lines 25-32, Fig. 1), thus a cross-section sized to bypass from 25% to 80 % of the mixture past the foam support element.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Lywood et al to eliminate the need for high activity catalysts (see column 3, lines 1-3).

Regarding claim 26, Horiike et al teaches the support defines a plurality of separate passageways within (see figures 2 and 3)

Horiike et al does not teach ceramic reticulated foam supports.

Fay, III et al teach that ceramic or metallic reticulated foam for catalyst systems provide much greater surface contact and mixing at equivalent or reduced pressure drops and reduced catalyst dimensions compared to honeycomb structure (column 3, line 41 – column 4, line 35).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Fay, III et al because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Fay, III et al column 3, lines 57-62).

Regarding claim 27, Horiike et al does not teach the passageway is disposed around a portion of a perimeter of the reticulated foam support.

Fay, III et al teach that ceramic or metallic reticulated foam for catalyst systems provide much greater surface contact and mixing at equivalent or reduced pressure drops and reduced catalyst dimensions compared to honeycomb structure (column 3, line 41 – column 4, line 35).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Fay, III et al because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Fay, III et al column 3, lines 57-62).

Lywood et al disclose using a catalyst body, which provides outer annular bypass region (see column 7, lines 25-32, Fig. 1), thus a bypass passageway disposed around a perimeter of the foam support as claimed.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teaches of Lywood et al to eliminate the need for high activity catalysts (see column 3, lines 1-3).

Regarding claim 29, Horiike et al does not teach the ceramic reticulated foam support comprises a donut-shaped cross-section.

Lywood et al disclose using a catalyst body having a central hole (column 7, lines 19-20, Fig. 1), thus a foam support comprising a donut-shaped cross-section as claimed.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Lywood because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Lywood et al column 3, lines 57-62).

Regarding claim 30, Horiike et al does not teach the reticulated foam support comprises a cross-section perimeter smaller than an internal perimeter of the pressure boundary, the foam support supported against the internal perimeter by spaced apart standoffs.

Fay, III et al teach that ceramic or metallic reticulated foam for catalyst systems provide much greater surface contact and mixing at equivalent or reduced pressure

drops and reduced catalyst dimensions compared to honeycomb structure (column 3, line 41 – column 4, line 35).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Fay, III et al because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Fay, III et al column 3, lines 57-62).

Lywood et al teaches a cross-section perimeter smaller than an internal perimeter of the pressure boundary, the support supported against the internal perimeter by spaced apart standoffs (see column 8, line 41-43).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Lywood because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Lywood et al column 3, lines 57-62).

Regarding claim 31, Horiike et al does not teach the reticulated foam support comprises a ceramic material.

Fay, III et al teach that ceramic or metallic reticulated foam for catalyst systems provide much greater surface contact and mixing at equivalent or reduced pressure drops and reduced catalyst dimensions compared to honeycomb structure (column 3, line 41 – column 4, line 35).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Fay, III et al because reticulated ceramic foam catalyst supports are capable of extended high temperature operation and provides for both exhaust conversion and sound suppression in the same unit (see Fay, III et al column 3, lines 57-62).

Claims 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1), Lywood et al (US 5,228,847), Bruck (US 6,365,283 B1), Fay, III et al (US 6,040,266) as applied to Claim 24, and further in view of Kato (US 5,439,651).

Regarding claim 28, Horiike et al do not teach the support comprises cruciform cross-section.

The Kato reference teaches a cruciform cross-section (see column 3, 5th paragraph and Figure 3).

It would have been obvious to one having ordinary skill in the art at the time the invention to have modified the combustor of the references as combined to provide a catalyst foam support with a cruciform cross-section, as suggested by Kato, to provide a foam support providing bypass passages of different cross-sectional area depending on the desired amount of bypass.

Claims 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1), Dalla Betta et al (US 5,183, 401), Bruck (US 6,365,283 B1), and Fay, III et al (US 6,040,266) as applied to claim 1, and further in view of Butler et al (RMRS-RP-9).

Claim 32 depends on claim 1 such that the reasoning used to reject claim 1 will be used to reject the dependent portions of the claim.

Regarding claim 32, Horiike et al does not teach the narrowed flow region is configured for generating a venture effective to limit flashback into the first catalytic stream from heat generated in the second catalytic stage.

Bruck teaches that as fluid flows through the catalyst support the channels increase causing a narrowing of flow (see figures 1 and 5).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Bruck to permit continuous catalytic conversion even under heavily fluctuating operating condition with phases in which relatively cold exhaust emissions reach the catalytic converter (see column 3, lines 61-65).

Butler et al defines the Venture effect as the increase in velocity of a stream of gas or liquid as it passes from one area through another area of smaller size or diameter.

The combined teachings of Horiike et al and Bruck teach the Venturi effect through the narrowing of channels through the catalytic combustor.

Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et al (US 6,475,446 B1), Dalla Betta et al (US 5,183, 401) and Bruck (US 6,365,283 B1) as applied to claim 6, and further in view of Butler et al (RMRS-RP-9).

Claim 33 depends on claim 6 such that the reasoning used to reject claim 6 will be used to reject the dependent portions of the claim.

Regarding claim 32, Horiike et al does not teach the narrowed flow region is configured for generating a venture effective to limit flashback into the first catalytic stream.

Bruck teaches that as fluid flows through the catalyst support the channels increase causing a narrowing of flow (see figures 1 and 5).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Horiike et al with the teachings of Bruck to permit continuous catalytic conversion even under heavily fluctuating operating condition with phases in which relatively cold exhaust emissions reach the catalytic converter (see column 3, lines 61-65).

Butler et al defines the Venture effect as the increase in velocity of a stream of gas or liquid as it passes from one area through another area of smaller size or diameter.

The combined teachings of Horiike et al and Bruck teach the Venturi effect through the narrowing of channels through the catalytic combustor.

Response to Arguments

Applicant's arguments, see page 9, line 31 through page 10, line 10, filed corrections to informalities, with respect to specifications and claim 1 have been fully considered and are persuasive. The objections of specification and claim 1 have been withdrawn.

Applicant's arguments, see page 10, lines 19-24, responding "a transition stage disposed between the first catalytic stage and the second catalytic stage, the transition

stage comprising a narrowed flow area region disposed between an inlet end receiving the partially oxidized fuell/oxidizer mixture from the first catalytic stage and an outlet end discharging the partially oxidized fuel/oxidizer mixture into the second catalytic stage", with respect to the rejection(s) of claim(s) 1 under 35 USC 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Horiike et al (US 4,475,446 B1) and Bruck (US 6,365,283 B1).

Applicant's arguments with respect to claims 2-5 have been considered but are moot in view of the new ground(s) of rejection.

Applicant's arguments, see page 10, line 32 through page 12, line 17, responding "second catalytic stage further comprises a plurality of separate catalytic elements disposed along a flow axis of the combustor, each of the plurality of separate catalytic elements comprising an identical cross-section and being annularly rotated about the flow axis with respect to an adjacent catalytic element effective to cause mixing of a flow about the flow axis" and "a transition stage disposed between the first catalytic stage and the second catalytic stage, the transition stage comprising a narrowed flow area region disposed between an inlet end receiving the partially oxidized fuell/oxidizer mixture from the first catalytic stage and an outlet end discharging the partially oxidized fuel/oxidizer mixture into the second catalytic stage", with respect to the rejection(s) of claim(s) 6 under 35 USC 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a

new ground(s) of rejection is made in view of Horiike et al (US 4,475,446 B1) and Bruck (US 6,365,283 B1).

Applicant's arguments with respect to claims 8-12, 14-16, and 18-22 have been considered but are moot in view of the new ground(s) of rejection.

Applicant's arguments, see page 12, line 23 through page 13, line 19, responding "a transition stage disposed between the upstream pressure boundary and the downstream pressure boundary, the transition pressure boundary comprising a narrowed flow area region effective to generate a venture effect disposed between an inlet end receiving the oxidized fuel/oxidizer mixture from the upstream pressure boundary and an outlet end discharging the partially oxidized fuel/oxidizer mixture into the downstream pressure boundary", with respect to the rejection(s) of claim(s) 24 under 35 USC 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Horiike et al (US 4,475,446 B1), Bruck (US 6,365,283 B1), and Butler et al (RMRS-RP-9).

Applicant's arguments with respect to claims 25-31 have been considered but are moot in view of the new ground(s) of rejection.

Rejections are provided for new claims 32-33.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Luoma et al (US 5,534,476), Ostroff (US 5,401,483), Socha, Jr.

(US 5,966,929), Maus et al (US 5,173,267), Bell et al (US 5,080,577), and Seo et al (The Catalytically Supported Combustor for Lean Mixtures, 1999).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Natasha Young whose telephone number is 571-270-3163. The examiner can normally be reached on Mon-Fri 7:30-5 (alternate Fri off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Walter Griffin can be reached on 571-272-1447. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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